INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

MODEL LM

H PACKAGE

THIS MANUAL APPLIES TO UNITS

BEARING SERIAL NO. PREFIX A

LAMBDA

LAMBDA ELECTRONICS CORP.–MELVILLE, L. I., N. Y.

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

MODEL LM

H PACKAGE

THIS MANUAL APPLIES TO UNITS

BEARING SERIAL NO. PREFIX A

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics Corp.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.

MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

IM-LMH

TABLE OF CONTENTS

SECTION	PAGE
SPECIFICATIONS AND FEATURES	1
Mounting	2
Model Options	2
THEORY OF OPERATION	3
General	3
Functional Description	3
Overvoltage Protector Circuit, Functional Description	3
OPERATING INSTRUCTIONS	5
Basic Mode of Operation	5
Connections for Operation	5
Operation After Protective Device Shutdown	5
MAINTENANCE	7
General	7
Trouble Analysis	7
Checking Transistors and Capacitors	7
Printed Circuit Board Maintenance Techniques	7
Trouble Chart	8
Performance Check	9
Adjustment of Calibration Control R17	9
Adjustment of OV ADJ Control OV-R1	10
SERVICE	12
PARTS ORDERING	12
PARTS LIST	R-1

SPECIFICATIONS AND FEATURES

The following specifications apply for all Lambda H package LM power supplies. Specification exceptions noted here relate to models incorporating model option "Y" and/or "T". Performance specifications do not change for models with suffix "R", e.g., LM-H4-R unless the models also include model options "Y" and/or "T" e.g., LM-H4-YR; for these models the appropriate specification exceptions also apply.

NOTE: Specifications in italics apply only for Lambda models with a "Y" suffix, e.g., LM-H4-Y. AC INPUT specification with an asterisk*, applies only for Lambda models with a "V" or with a "T" suffix, e.g., LM-H4-YT.

DC OUTPUT--Voltage regulated for line and load

Voltage Range.... For voltage range see table I of pertinent model group, or appropriate schematic diagram of individual unit.

Multi-Current Ratings.... Current ratings specified for each maximum ambient temperature apply over entire output voltage range, with input frequency 55-65 cps. For input frequencies 45-55 at 105-132 VAC or 200-250 VAC, derate maximum current ratings 10% at all ambient temperatures; for frequencies 45-55 at 205-265 VAC, 40° current rating does not apply.

For input frequencies 360-440 cps, consult factory for current ratings.

For maximum current ratings at each ambient temperature see table I of pertinent model group.

REGULATED VOLTAGE OUTPUT

Regulation (line)... Less than 0.05 percent plus 4.0 millivolts for input variations from 105-132 or 132-105 volts AC

... Less than 0.01 percent plus 1.0 millivolt for input variations from 105-132 or 132-105 volts AC

Regulation (load)... Less than 0.03 percent plus 3.0 millivolts for load variations from 0 to full load or full load to 0

... Less than 0.02 percent plus 2.0 millivolts for load variations from 0 to full load or full load to 0.

Remote Programming

External Resistor... Nominal 200 ohms/volt output

Programming Voltage... One-to-one voltage change

Ripple and Noise... One millivolt rms; 3 millivolts peak-to-peak with 45-65 cps input

... 0.5 millivolt rms; 3 millivolts peak-to-peak with 45-65 cps input

Temperature Coefficient... Change in output voltage less than $0.03\%/^{\circ}C$

... Change in output voltage less than $0.01\%/^{\circ}C$

AC INPUT --105-132 volts AC at 45-440 cps; 2200 watts+

+ With output loaded to full $40^{\circ}C$ rating and input voltage 132 volts at 55-65 cps.

*... 200-250 volts AC at 45-440 cps ("T" option)

*... 205-265 volts AC at 45-440 cps ("V" option)

INPUT FUSE--"SLO-BLO" fuse F1 protects the AC input circuit. Overload of the supply does not cause fuse failure.

OVERLOAD PROTECTION

Thermal.... Thermostat resets automatically when overtemperature condition is eliminated; CB1 must be manually reset to "ON" position to apply input power.

Electrical... Within rated voltage range, an automatic electronic current-limiting circuit limits output current to approximately 110 percent of 40°C rated current for protection of load and power supply; for overloads approaching short circuit, both voltage and current decrease until at short circuit, current is approximately 30 percent or less of rated current, except for model LMH-0-7, where output current remains limited to approximately 110 percent of 40°C rated current at 40°C ambient.

OVERSHOOT--No overshoot of output voltage under conditions of power turn-on, power turn-off, or power failure.

INPUT AND OUTPUT CONNECTIONS--Heavy duty terminal block on rear of chassis

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE--Continuous duty from 0°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE-- -55°C to +85°C

METERS--Voltmeter and ammeter monitor the voltage and load output current respectively on metered (M) models.

CONTROLS

DC output control...VOLT ADJ. control on front panel of all units permits adjustment of DC output voltage.

Overvoltage Control...On units with overvoltage circuit, OV ADJ control permits setting of the overvoltage protection point.

Power... Panel-mounted magnetic circuit breaker and indicator light on all models. The circuit breaker controls application of input power to the supply. On units with OV option, overvoltage condition causes the breaker to trip. When the breaker or switch is in the ON position the red ON indicator lamp glows.

REMOTE SENSING--Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

PHYSICAL DATA

Size..... 7" H x 19" W x 18-1/2"D

Weight ..... 110 lbs. net; 145 lbs. shipping wt.

Panel Finish..... Brushed aluminum clear anodized panels with grey inlay (Standard); special finishes available to customer's specifications at moderate surcharge

MOUNTING--Standard 19" rack mounting.

MODEL OPTIONS

Suffix "T" Input Option... Standard LM power supplies are available for operation with 200-250 volt, 45-440 cps input.

Suffix "Y" High Performance Option... All Lambda LM power supplies are available with high performance specifications. See italicized entries under SPECIFICATIONS AND FEATURES.

Suffix "R" Fungus Proofing Option... Standard LM power supplies can be obtained with fungus proofing treatment with MIL V 173 varnish for all fungi nutrient components.

Suffix "M" Meter Option... All Lambda LM power supplies are available with voltmeter and ammeter.

Suffix "OV" Overvoltage Protection Option... LM-H power supplies are available with a built-in overvoltage protection circuit which prevents damage to the load that can be caused by excessive power supply output voltage.

Suffix "V" Input Option... Standard LM power supplies are available for operation with 205-265 volt 45-440 cps input.

GENERAL

The Lambda power supply consists of an AC input circuit and transformer; a bias supply consisting of an auxiliary rectifier, filter, and a zener diode regulator; a drive supply consisting of a rectifier and filter; and a main regulator circuit consisting of the main rectifier and filter, a series regulator, emitter follower drivers, an error amplifier, a current limit amplifier, an output voltage sensing circuit and an output current sensing resistor. In addition a fault protector circuit is provided and, as applicable, a voltage amplifier.

The circuit arrangement is shown in block diagram form in figure 7. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single phase input power is applied to transformer T1 through the input circuit containing circuit breaker CB1. Thermostat S1, protects the supply against overheating. S1, normally open, closes when an overtemperature condition occurs, causing CB1 to open, cutting off primary power.

The main rectifier, a full-wave rectifier, provides the power which is filtered and then regulated via a series regulator and delivered to the output. Bias supply, half-wave auxiliary rectifier CR7, provides voltage filtered by capacitor C7 and regulated by zener diode CR6 for current limit amplifier Q3, fault protector Q7 and error amplifier Q1, Q2 (or for voltage amplifier Q2). Zener diode CR1 and resistor R5, across the bias supply provide a regulated temperature compensated reference voltage. Resistor R4 compensates for input voltage variations. As applicable, the drive supply, a full-wave rectifier, provides voltage for drivers Q5, Q6.

Operation of the voltage regulator circuit is determined by changes in the output voltage. A change in the output voltage is sensed by the sensing divider resistors which compare output voltage with the +S reference voltage. This provides an error voltage at junction of R2 and R3, (or as applicable R1 and R3) which is amplified by error amplifier Q1, and Q2 (and as applicable by voltage amplifier Q2) and is current amplified by drivers Q5, Q6. The amplified signal from the drivers controls the voltage across the series regulator transistors, which function as the active regulating element, restoring output voltage to the proper level.

*Current limit circuit operation is determined by changes in the load. Current limit amplifier Q3 samples load current through current sensing resistor R25A. When the voltage drop across this resistor increases compared with the preset voltage reference determined by R17 and R18 (when used), Q3 conducts. Thus, when the output current rating of the unit is exceeded, current limit amplifier Q3 conducts, decreasing the current through drivers Q5, Q6, resulting in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by the factory setting of current limit potentiometer R17.

When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by R17 and R18 (when used) is proportional to the output voltage, when the output voltage decreases, Q3 is biased into turn-on at lower and lower load currents until output voltage decreases to zero and current decreases to a predetermined low value.

*The following paragraph only applies for model LMH-0-7 with voltage amplifier Q2.

Current limit circuit operation is determined by changes in the load. When load current increases above the rated current value, the voltage drop across current limit potentiometer R17 increases, turning on current limit amplifier Q3. With Q3 conducting, the current to drivers Q5, Q6 is limited, in turn limiting the base current to the series regulator which results in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by the factory setting of current limit potentiometer R17. When operating conditions reach short circuit, the output voltage value decreases to zero and the current is limited to a predetermined current limit value and remains unchanged.

During normal operation of the supply, with no faults occurring, fault protector transistor Q7 is at cutoff and not conducting. When an operation malfunction occurs because of open sense leads or improper series regulator operation, increased current through R39 causes Q7 to be biased on. With Q7 conducting, drive current is diverted from drivers Q5, Q6 and from the series regulator through fault protector Q7, thereby protecting these transistors from damage that can be caused by excessive drive current.

OVERVOLTAGE PROTECTOR CIRCUIT, FUNCTIONAL DESCRIPTION

Divider network OV-R1, OV-R2, OV-R3, OV-R4 and OV-R7 monitors the power supply output voltage. When the power supply output voltage increases above the overvoltage limit set by OV ADJ control OV-R1, the voltage of the divider network also increases, biasing transistor OV-Q1 on. OV-Q1, in turn, biases OV-Q2 on through resistor OV-R10. OV-Q2 supplies gate current to OV-SCR-1, turning it on, driving current through the breaker trip coil and into the gate of SCR-71, turning SCR-71 on. This, in turn, causes the voltage at the power supply terminals to drop, protecting the load from excessive supply output voltage. OV-SCR-1 and SCR-71 conduct until the circuit breaker trips, causing power to the power supply to be cut off.

CAUTION

The overvoltage protector will not provide protection against overvoltage conditions caused by storage batteries or other power sources used in conjunction with the Lambda power supply. Whenever additional power sources must be used with the Lambda power supply and overvoltage protector combination, consult the factory for proper installation information.

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When load current exceeds 110% of 40°C rating, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 30 percent of the rated current, except for model LMH-0-7, where output current remains limited to approximately 110% of 40°C current rating.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block on the rear of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The supply positive terminal is brought out to terminal 6; the negative terminal to terminal 4.

NOTE: When shipped from the factory, the supply is ready for use as a local-sensing constant voltage source. Jumpers are connected at the factory as shown in figure 3. Take care to remove the appropriate jumpers for load requirements that need different supply-load connections. Refer to the appropriate connection diagram.

Supply-Load Connections. The regulation of the supply at the load may change when connecting leads of practical length are used. To minimize the effect of the output load leads, remote sensing is used. Refer to figure 1 to determine voltage drop for particular cable lengths, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local-Sensing Connection, See Figure 3.

Remote-Sensing Connection, See Figure 4.

NOTE: For all models except LMH-0-7, whenever the supply is connected for remote sensing, the total voltage drop across both load leads must not exceed the 5 percent output voltage band width of the power supply.

Programmed Voltage Connection Using External Resistor, See Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at nominal 200 ohms/volt output and a shorting-type switch. For continuous voltage variations, use a variable resistor with the same ohms/volt ratio in place of the voltage divider and shorting-type switch. Use low temperature coefficient resistor(s) to assure most stable operation.

Programmed Voltage Connection Using Programming Voltage, See Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply.

The programming supply must have a reverse current capability of 6 ma. minimum.

Alternatively, when supplies with less than 6 ma. reverse current capability are used, a resistor capable of drawing 6 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat causes the circuit breaker to open the input circuit only when the power supply output current exceeds the current rating specified for the operating ambient temperature causing the temperature of the transistor heat radiator to exceed a maximum safe value. The thermostat will automatically reset when the temperature of the radiator decreases to safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply by placing circuit breaker in "ON" position.

Fuse Shutdown

Internal component failure is prevented by fuses which protect the components from damage caused by excessive currents. Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Circuit-Breaker Shutdown (For "OV" Suffix Models)

The ON-OFF circuit breaker controls application of input power to all Model LM-H power supplies with built in overvoltage protection. When the power supply output voltage increases above the preset overvoltage limit, the breaker trips, opening the input circuit, causing the ON-OFF indicator to extinguish. After eliminating the cause(s) for overvoltage, resume operation of the supply by placing circuit breaker in ON position.

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 7, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

> NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.

3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

   (a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

   (b) Dip the wick in liquid rosin flux.

(c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

(d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes, and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

(a) AC power of proper voltage and frequency is present at input terminals.

(b) Either positive or negative terminal is connected to chassis ground.

(c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE CHART

Symptom	Probable Cause	Remedy
1. No output voltage	No power input, thermostat S1 closed	Check power source, S1, line cord and line cord plug; shut off unit, allow to cool and check ambient temperature
	Improper output terminal connection	Refer to appropriate connection diagram, and check for correct connections
	Faulty Q2, Q3, CR1, CR6	Check Q2, Q3, CR1, CR6 for short and replace as required
2. Unable to adjust output voltage	Damaged VOLTAGE ADJUST control	Check R1 for shorts and/or open: replace as required
	Supply operating as constant current source at current limit value	Remove load, check load value and check for shorts and/or improper supply-load connections; refer to appropriate diagram for correct connections
3. Output voltage too high	Improper output terminal connection	Refer to appropriate connection diagram, and check for correct connections
On OV units, breaker trips and cannot be reset	Improper adjustment of OV ADJ control	Refer to procedure for adjusting OV ADJ control and reset control
	Faulty Q1, R1, Q8-Q27, Q5, Q6 or CR1	Check R1 for open; Q8-Q27, Q5, Q6, Q1 for short; CR1 for open and replace as required
	OV-Q1, OV-Q2, OV-SCR 1 on OV subassembly faulty (least probable fault cause)	Check OV-Q1, OV-Q2, OV-SCR 1 for short and replace as required
4. Output voltage too low	Load resistance improper for unit ratings	Check load resistance value
	Faulty Q2, Q3, R25A, R17	Check Q2, Q3 for short, R25A, R17 for open, replace as required

TROUBLE CHART (Cont'd)

Symptom	Probable Cause	Remedy
4. (Cont'd)		
Output voltage too low on units with OV option	Faulty SCR 71 in OV circuit (least probable fault cause)	Remove cathode connection to SCR 71 and reapply power, if output is restored SCR 71 is faulty; replace SCR 71
5. High ripple and unregulated DC output	Load resistance improper for unit ratings	Check load resistance value
6. High ripple	Improper ground	Connect terminal 6 or terminal 4 to ground terminal 5

PERFORMANCE CHECK

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 8. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC VTVM (John Fluke Model 85A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the full load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132 -105 volts AC and check the power supply line regulation accuracy on the VTVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R17

The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C and has not been operated with load for at least one hour.

Whenever Q2, R25A or R17 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R17 as follows:

1. Remove AC power input to the supply.

2. Unsolder wiper of R17 from resistor housing and turn to full CW position.

3. Operate power supply for constant voltage with local sensing, connected as shown in figure 3, with no external load.

4.* Turn voltage adjust control until minimum rated output voltage is obtained.

5.* Apply load so that output current is 110% of 40°C rating for the unit.

6.* Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R17 in a CCW direction. Adjust R17 until output ripple increases sharply and oscilloscope pattern changes.

7.* After adjustment is completed, remove AC power input to the supply and solder wiper of R17 to resistor housing.

8.* After soldering, check setting and repeat adjustment procedure if required.

* Perform alternate steps 4A through 8A for adjustment of R17 on model LMH-5-7.

4A. Turn voltage adjust control until rated output voltage is obtained.

5A. Apply load so that output current is 120% of 40°C rating for the unit.

6A. Using an oscilloscope, Tektronix 503 or equivalent, observe unit output voltage while adjusting R17 in a CCW direction. Adjust R17 until output ripple increases sharply and oscilloscope pattern changes.

7A. After adjustment is completed, remove AC power input to the supply and solder wiper of R17 to resistor housing.

8A. After soldering, check setting and repeat adjustment procedure if required.

ADJUSTMENT OF OV ADJ CONTROL OV-R1

Adjust the voltage-protection point of overvoltage protector circuit as follows:

1. Turn OV ADJ control on front panel fully clockwise.

2. The recommended voltage-protection point is 115% of normal power supply operation voltage plus one volt. Compute this value for the operation voltage being used.

3. Turn on the power supply, and raise the output voltage to the desired voltage-protection point; monitor the power supply output voltage to assure correct voltage. If the power supply does not have an adequate adjustment range omit steps 4 and 5, and continue with step 6 below.

4. Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips, indicating that the voltage protection point is reached.

5. The voltage-protection point is now set. Reduce power supply output voltage setting before re-applying input power.

6. If the power supply output voltage adjustment range does not extend to the protection-point voltage computed in step 2, proceed as follows:

   a) Turn on power supply and raise output voltage to the normal operating voltage.

   b) Slowly turn the OV ADJ control counterclockwise until the circuit breaker trips.

   c) Refer to chart below, select appropriate volts/turn ratio, and turn OV ADJ control clockwise by the number of turns equivalent to 1 volt plus 15% of the operating voltage.

MODEL	VOLTS/TURN	OVERVOLTAGE ADJUSTMENT RANGE
LM-H3, H3P6, H4, H4P5, H5, H6	0.3	3 - 8v
LM-H10, H12	0.8	6 - 20v

For Example:

When using power supply LM-H5-OV with output voltage setting of 5 volts, calculate as follows:

$$T = \frac{1 + .15\,(OV)}{V/T}$$

where

T = turns of OV ADJ control

OV = operating voltage of power supply

V/T = volts/turn ratio from chart

$$T = \frac{1 + .15(5)}{0.3} = 5.8$$

Rotate OV ADJ control 5.8 turns in clockwise direction to obtain a voltage setting 1.8 volts above the 5-volt power supply setting, or 6.8 volts.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

PARTS LIST

The electrical parts located on all LM-H models are listed here. Parts common to a group of LM-H models are listed first. Unique parts of individual models with the group are listed separately, by model, immediately following the group common-parts listing. In addition there are separate listings of parts for the Y option and the overvoltage protection (OV) option, as applicable, for all LM-H models. The parts listed for model LM-H-0-7 do not utilize the common parts-unique parts listings; all the parts for this model are sequentially listed under the applicable heading "PARTS FOR MODEL LM-H 0-7." Parts for the T option, V option and R option are included at the end of this listing.

COMMON PARTS

MODELS LM-H3—LM-H12

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C1	Cap., paper, 0.15 mf ± 10% 400 vdc	CAM-15-017	$ 1.80
C2	Cap., mylar, 0.22 mf ± 10% 80 vdc	CGM-22-004	.90
C3	Cap., elect, 37000 mf -10% +100% 20 vdc	CBT-37-015	13.50
C4	Cap., elect, 3.0 mf -10% +75% 100 vdc	CBN-30-015	1.58
C5	Cap., mylar 0.033 mf ±10% 100 vdc	CGL-33-011	.25
C6	Cap., mylar 0.018 mf ±10% 200 V	CGL-18-005	.24
C7*	Cap., elect, 140 mf-10% +100% 30 vdc	CBR-14-030	2.25
C8	Not assigned		
C9	Cap., paper, 1.0 mf ±20% 200 vdc	CAN-10-024	1.24
C10	Same as C9		
C11 Thru C14	Not assigned		
C15	Cap., elect., 4900 mf -10% +100% 20 vdc	CBS-49-041	7.50
C16	Cap., mylar, 0.068 mf ±10% 200 vdc	CGL-68-003	.53
C17	Same as C16		
C18 Thru C24	Same as C3		
C25	Same as C2		
C28	Not assigned		
C30	Cap., mylar, 0.022 mf ±10% 200 vdc	CGL-22-001	.39
C31	Cap., elect, 150 mf, -10% +75% 45 vdc	CBR-15-051	.20
C32	Not assigned		
C33	Not assigned		
C34	Cap., mylar, 0.001 mf ± 10% 200 vdc	CGK-10-004	.21
CB1	Switch, circuit breaker type with coil	FHC-01-001-2	12.15
CR1*	Rectifier, zener diode	FBM-Z104	4.35

COMMON PARTS (Cont)

MODELS LM-H3—LM-H12 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
CR2	Rectifier	FBL-00-030	$ 1.40
CR3	Same as CR2		
CR4	Not assigned		
CR5	Not assigned		
CR6	Rectifer, zener diode	FBM-Z103	4.87
CR7	Same as CR2		
CR8	Rectifier	FBL-00-061	5.50
CR10	Same as CR8		
CR12 Thru CR15	Not assigned		
CR16	Rectifier	FBL-00-054	1.35
CR17	Same as CR16		
DS1	Pilot lamp	HRD-00-009	3.10
F1	Fuse, 30 amperes	FFH-30-000	.75
Q1	Transistor NPN	FBN-L110	3.25
Q2	Same as Q1		
Q3	Same as Q1		
Q4	Not assigned		
Q5	Transistor, NPN	FBN-L113	1.96
Q7	Transistor, NPN	FBN-L125	.80
R3	Res, ww, 1200 ohms ±3% 2 w	DFS-12-030	.90
R4*	Res., film, 15,000 ohms ±2% 1/2 w	DCT-15-013	.30
R5	Res., film, 220 ohms ± 2% 1/2 w	DCR-22-005	.30
R6	Res., comp., 180,000 ohms ±10% 1/2 w	DEB-1841	.12
R7	Res., film, 3900 ohms ±5% 1/2 w	DCS-39-014	.25
R8	Res., comp., 4700 ohms ±10% 1/2w	DEB-4721	.12
R9	Res., comp., 68 ohms ±10% 1/2 w	DEB-6801	.12
R10	Res., comp., 1800 ohms ±10% 1/2 w	DEB-1821	.12
R11	Res., comp., 22000 ohms ±10% 1/2 w	DEB-2231	.12
R12	Not assigned		
R13*	Res., ww, 600 ohms ±3% 3 w	DFR-60-005	.89
R14	Not assigned		

COMMON PARTS (Cont)

MODELS LM-H3—LM-H12 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R15	Not assigned		
R16	Res., comp., 560 ohms ± 10% 1/2 w	DEB-5611	$ .12
R17	Res., var., ww, 1200 ohms ±10% 1-1/2 w	DNS-12-026	1.25
R19 Thru R21	Not assigned		
R22	Same as R9		
R23	Res., comp., 6.8 ohms ±10% 1/2 w	DEB-68G1	.12
R25A Thru R34B	Res., ww, tapped, two sections, 0.10 ohms ±5% 11 w/section	DFM-20-054	1.50
R35 Thru R37	Not assigned		
R38	Res., comp. 330 ohms ±10% 1/2 w	DEB-3311	.12
R43 Thru R46	Not assigned		
R47	Res., ww, 0.36 ohms ±5% 22 w	DFM-36-049	1.60
R333	Res., ww, 2.0 ohms ±3% 3 w	DFN-20-009	.60
S1	Thermostat	FKA-139-018	2.50
XF1	Fuseholder	HRM-00-004	.93

* This part not used on units with "Y" option.

UNIQUE PARTS

MODEL LM-H3

C26	Cap. elect., 37000 mf -10% + 100% 20 vdc	CBT-37-015	13.50
C27	Cap., elect., 140 mf -10 + 100% 30 vde	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-5 vdc	EBN-50-006	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	FBN-36972	6.50
Q8 Thru Q27	Same as Q6		
R1	Res., var., ww 300 ohms ±5% 5 w	DNR-30-018	1.95
R2	Res., ww, 430 ohms ±3% 3 w	DFR-43-058	.50
R18	Not assigned		
R24	Res., film, 68 ohms ±10% 2 w	DCP-68-004	1.80
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15
R41+	Res., meter shunt 150 amps	ESR-15-002	12.00
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	.10
T1	Transformer	ABA-H3	150.00

+ This part only used on units with "M" meter option

UNIQUE PARTS (Cont)

MODEL LM-H3P6

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C26	Cap., elect, 37000 mf -10 + 100% 20 vdc	CBT-37-015	$ 13.50
C27	Cap., elect., 140 mf -10+100% 30 vdc	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-5 vdc	EBN-50-006	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	FBN-36972	6.50
Q8 thru Q27	Same as Q6		
R1	Res., var.,ww, 300 ohms ±5% 5 w	DNR-30-018	1.95
R2	Res., ww, 430 ohms ± 3% 3 w	DFR-43-058	.50
R18	Not assigned		
R24	Res., film, 68 ohms ±10% 2 w	DCP-68-004	1.80
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15
R41+	Res., meter shunt 150 amps	ESR-15-002	12.00
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	.10
T1	Transformer	ABA-H5	150.00

+ This part only used on units with "M" meter option

MODEL LM-H4

C26	Cap., elect, 37000 mf -10 + 100% 20 vdc	CBT-37-015	13.50
C27	Cap., elect., 140 mf -10 + 100% 30 vdc	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-5 vdc	EBN-50-006	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	FBN-36972	6.50
Q8 thru Q27	Same as Q6		
R1	Res., var., ww 600 ohms ±5% 5 w	DNR-12-030	.25
R2	Res., ww, 600 ohms ±3% 3 w	DFR-60-005	.89
R18	Not assigned		
R24	Res., film, 68 ohms ±10% 2 w	DCP-68-004	1.80
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15
R41+	Res., meter shunt 150 amps	ESR-15-002	12.00

UNIQUE PARTS (Cont)

MODEL LM-H4 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	$ .10
T1	Transformer	ABA-H5	150.00

+ This part only used on units with "M" meter option

MODEL LM-H4P5

C26	Cap., elect., 37000 mf -10 + 100% 20 vdc	CBT-37-015	13.50
C27	Cap., elect., 140 mf -10 + 100% 30 vdc	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-5 vdc	EBN-50-006	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	EBN-36972	6.50
Q8 thru Q27	Same as Q6		
R1	Res., var., ww 600 ohms ±5% 5 w	DNR-60-026	.25
R2	Res., ww, 650 ohms ±3% 3 w	DFR-65-062	.89
R18	Not assigned		
R24	Res., film, 180 ohms ±10% 2 w	DCR-18-012	.20
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15
R41+	Res., meter shunt 150 amps	ESR-15-002	12.00
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	.10
T1	Transformer	ABA-H5	150.00

+ This part only used on units with "M" meter option

MODEL LM-H5

C26	Cap., elect., 37000 mf -10 + 100% 20 vdc	CBT-37-015	13.50
C27	Cap., elect., 140 mf -10 + 100% 30 vdc	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-8 vdc	EBN-80-007	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	FBN-36972	6.50
Q8 thru Q27	Same as Q6		
R1	Res., var., ww 600 ohms ±5% 5 w	DNR-60-026	.25
R2	Res., ww, 650 ohms ±3% 3 w	DFR-65-062	1.00
R18	Res., film, 1300 ohms ±5% 1/2 w	DCS-13-010	.25
R24	Res., film, 180 ohms ±10% 2 w	DCR-18-012	1.80
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15

UNIQUE PARTS (Cont)

MODEL LM-H5 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R41+	Res., meter shunt 150 amps	ESR-15-002	$ 12.00
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	.10
T1	Transformer	ABA-H5	150.00

+ This part only used on units with "M" meter option

MODEL LM-H6

C26	Not assigned		
C27	Cap., elect., 140 mf -10 + 100% 30 vdc	CBR-14-030	2.25
C29	Same as C27		
CR9	Rectifier	FBL-00-061	5.50
CR11	Same as CR9		
M1+	Volmeter 0-8 vdc	EBN-80-007	12.50
M2+	Ammeter 0-150 amperes	EDR-15-003	12.50
Q6	Transistor NPN	FBN-36972	6.50
Q8 thru Q27	Same as Q6		
R1	Res., var., ww 600 ohms ±5% 5 w	DNR-60-026	.25
R2	Res., ww, 800 ohms ±3% 3 w	DFR-80-037	.84
R18	Res., film, 1300 ohms ±5% 1/2 w	DCS-13-010	.25
R24	Res., film, 180 ohms ±10% 2 w	DCR-18-012	.20
R39	Res., ww, 0.087 ohms ±5% 5 w	DFL-87-011	1.45
R40	Res., comp., 470 ohms ±10% 2 w	DHB-4711	.15
R41+	Res., meter shunt 150 amps	ESR-15-002	12.00
R42	Res., comp., 12 ohms ±10% 1/2 w	DEB-1201	.10
T1	Transformer	ABA-H07	150.00

+ This part only used on units with "M" meter option

MODEL LM-H10

C26 thru C29	Not assigned		
CR9	Not assigned		
CR11	Not assigned		
M1+	Volmeter 0-15 vdc	EBP-15-020	12.50
M2+	Ammeter 0-100 amperes	EDR-10-002	12.50
Q6	Transistor, NPN	FBN-36485	4.13
Q8 thru Q27	Transistor, NPN	FBN-36972	6.50
R1	Res., var., ww 2200 ohms ±5% 5 w	DNS-22-053	1.75
R2	Res., ww, 1200 ohms ± 3% 2 w	DFS-12-030	.50
R18	Res., film, 2400 ohms ±5% 1/2 w	DCS-24-001	.25
R24	Res., film 470 ohms ±10% 2 w	DCR-47-013	.15
R39	Res., ww, 0.17 ohms ±5% 3 w	DFM-17-052	1.50
R40	Res., comp.,470 ohms ±10% 2 w	DHB-4711	.15

UNIQUE PARTS (Cont)

MODEL LM-H10 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R41+	Res., meter shunt 100 amps	ESR-10-001	$ 9.25
R42	Res., comp., 33 ohms ± 10% 1/2 w	DEB-3301	.12
T1	Transformer	ABA-H12	150.00

+ This part only used on units with "M" meter option.

PARTS FOR MODEL LM-H12

C26 thru C29	Model LM-H12 Not assigned Same as C27		
CR9	Not assigned		
CR11	Not assigned		
M1+	Voltmeter 0-15 vdc	EBP-15-020	12.50
M2+	Ammeter 0-100 amperes	EDR-10-002	12.50
Q6	Transistor, NPN	FBN-36485	4.13
Q8 thru Q27	Transistor, NPN	FBN-36972	6.50
R1	Res., var., ww 2200 ohms ± 5% 5w	DNS-22-053	1.75
R2	Res., ww, 1800 ohms ± 3% 3w	DFS-12-030	.90
R18	Res., film 2400 ohms ± 5% 1/2w	DCS-24-001	.25
R24	Res., film, 470 ohms ± 10% 2w	DCR-47-013	1.15
R39	Res., ww, 0.17 ohms ± 5% 3w	DFM-17-052	1.50
R40	Res., comp., 1000 ohms ± 10% 2w	DHB-1021	.15
R41+	Res., meter shunt 80 amps	ESR-10-001	9.25
R42	Res., comp., 33 ohms ± 10% 1/2w	DEB-3301	.12
T1+	Transformer	ABA-H12	150.00

+ This part only used on units with "M" meter option.

PARTS FOR MODEL LM-H-0-7

C1	Cap., paper, 0.15 mf ± 10% 400vdc	CAM-15-017	1.80
C2	Cap., mylar, 0.22 mf ± 10% 80vdc	CGM-22-004	.90
C3	Cap., elect., 37000 mf -10% +100% 20vdc	COT-37-015	13.50
C4	Cap., elect., 3.0 mf -10% +75% 100vdc	CBN-30-015	1.58
C5	Cap., mylar, 0.018 mf ± 10% 200vdc	CGL-18-005	.24
C6	Same as C5		
C7 *	Cap., elect., 140 mf -10% +100% 30vdc	CBR-14-030	2.25
C8	Not assigned		
C9	Cap., paper, 1.0 mf ± 20% 200vdc	CAN-10-024	1.24
C10	Same as C9		
C11	Not assigned		
C12	Cap., mylar, 0.001 mf ± 10% 200 vdc	CGK-10-004	.21
C13	Not assigned		
C14	Not assigned		
C15	Cap., elect., 4900 mf -10% +100% 20vdc	CBS-49-041	7.50
C16	Cap., mylar, 0.068 mf ± 10% 200 vdc	CGL-68-003	.53
C17	Same as C16		
C18 thru C21	Same as C3		
C22 thru C24	Not assigned		

PARTS FOR MODEL LM-H-0-7 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C25	Same as C5		
C26 thru C29	Not assigned		
C30	Cap., mylar, 0.022 mf ± 10% 200 vdc	CGL-22-001	$ .39
C31	Cap., elect., 150 mf, -10% +75% 45 vdc	CBR-15-051	.20
C32	Not assigned		
C33	Not assigned		
C34	Cap., ceramic disc type, 240 mmf ± 20%, 1000 vdc	CDJ-24-001	.12
C35	Cap., mylar, 0.0033 mf ± 10% 200 vdc	CGK-33-003	.33
CB1	Switch, circuit breaker type with coil	FHC-01-001-2	12.15
CR1 *	Rectifier, zener diode	FBM-Z104	4.35
CR2	Rectifier	FBL-00-030	1.40
CR3 thru CR5	Not assigned		
CR6	Rectifier, zener diode	FBM-Z103	4.87
CR7	Same as CR2		
CR8	Rectifier	FBL-00-061	5.50
CR9	Not assigned		
CR10	Same as CR8		
CR11	Not assigned		
CR12	Same as CR8		
CR13 thru CR15	Not assigned		
CR16	Rectifier	FBL-00-054	1.35
CR17	Same as CR16		
CR18	Same as CR2		
CR19	Same as CR2		
DS1	Pilot lamp	HRD-00-009	3.10
F1	Fuse, 30 amperes	FFH-30-000	.75
M1 +	Voltmeter 0-8vdc	EBN-80-007	12.50
M2 +	Ammeter 0-80 A	EDP-80-022	12.50
Q1	Transistor, NPN	FBN-L110	3.25
Q2	Same as Q1		
Q3	Same as Q1		
Q4	Not assigned		
Q5	Transistor, NPN	FBN-L113	1.96
Q6	Transistor, NPN	FBN-36485	4.13
Q7	Transistor, NPN	FBN-L125	.80
Q8 thru Q27	Same as Q6		
Q28	Same as Q5		
R1	Res., var., ww, 2200 ohms ± 5%, 5w	DNS-22-053 or DNS-22-023	1.75
R2	Not assigned		
R3	Res., ww, 1100 ohms ± 3% 2w	DFS-11-061	.60
R4 *	Res., film, 15,000 ohms ± 2% 1/2w	DCT-15-013	.30
R5	Res., film, 220 ohms ± 2% 1/2w	DCR-22-005	.30
R6	Res., comp., 180,000 ohms ± 10% 1/2w	DEB-1841	.12
R7	Res., film, 3900 ohms ± 5% 1/2w	DCS-39-014	.25
R8	Res., comp., 4700 ohms ± 10% 1/2w	DEB-4721	.12
R9	Res., comp., 150 ohms ± 10% 1/4w	DCB-1511	.10

PARTS FOR MODEL LM-H-0-7 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
R10	Res., comp., 1800 ohms ± 10% 1/2w	DEB-1821	$ .12
R11	Res., comp., 22000 ohms ± 10% 1/2w	DEB-2231	.12
R12	Not assigned		
R13 *	Res., ww, 600 ohms ± 3% 3w	DFR-60-005	.89
R14	Not assigned		
R15	Not assigned		
R16	Res., comp., 560 ohms ± 10% 1/2w	DEB-5611	.12
R17	Res., var., ww, 1200 ohms ± 10% 1-1/2w	DNS-12-026	1.25
R18 thru R21	Not assigned		
R22	Res., comp., 68 ohms ± 10% 1/2w	DEB-6801	.12
R23	Res., comp., 6.8 ohms ± 10% 1/2w	DEB-68G1	.12
R24	Not assigned		
R25A thru R34B	Res., ww, tapped, two sections, 0.30 ohms ± 5%, 11w/section	DFM-60-050	1.45
R35	Not assigned		
R36	Not assigned		
R37	Not assigned		
R38	Res., comp. 330 ohms ± 10%, 1/2w	DEB-3311	.12
R39	Res., ww, 0.17 ohms ± 5% 3w	DFM-17-052	1.50
R40	Res., comp., 270 ohms ± 10% 2w	DHB-2711	.15
R41 +	Res., meter shunt 80A	ESP-80-003	9.25
R42	Res., comp., 33 ohms ± 10% 1/2w	DEB-3301	.12
R43	Res., comp., 150 ohms ± 10% 1/2w	DEB-1511	.12
R44	Res., comp., 470 ohms ± 10% 2w	DHB-4711	.15
R45	Res., comp., 220 ohms ± 10% 1w	DGB-2211	.10
R46	Res., comp., 10 ohms ± 10% 1/2w	DEB-1001	.12
R47	Res., ww, 0.36 ohms ± 5% 22w	DFM-36-049	1.60
R333	Res., ww, 2.0 ohms ± 3% 3w	DFN-20-009	.60
S1	Thermostat	FKA-139-018	2.50
T1	Transformer	ABA-H07	150.00
XF1	Fuseholder	HRM-00-004	.93

* This part not used on units with "Y" option.

\+ This part only used on units with "M" meter option.

PARTS FOR "OV" OPTION

Models LM-H3 — LM-H12 and LM-H-0-7

The following parts are used only in LM-H models with the "OV" option.

LMOV-F overvoltage subassembly used on Models LM-H3 thru LM-H6, and LM-H-07 (see separate electrical parts list LMOV-1F for components located on this subassembly.) — LMOV-1F

LMOV-2 overvoltage subassembly used on models — LMOV-2F

PARTS FOR "OV" OPTION (Cont)

MODELS LM-H3—LM-H12 AND LM-H-0-7 (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
LM-H10 and LM-H12 (See separate electrical parts list LMOV-2F for components located on this subassembly.			
C71	Cap., elect., 10 mf -10 + 100% 25vdc	CBP-10-018	$ 1.53
R72	Res., comp., 3.3 ohms ± 10% 1/2w	DEB-33G1	.12
R73	Res., ww 1.0 ohms ± 3% 3w	DFN-10-041	.66
SCR71	Rectifier, silicon, controlled	FBP-00-010	12.50

COMMON PARTS

MODELS LMOV-1F, 2F

C1	Cap., mylar 0.01 mf ± 20% 80 vdc	CGL-10-008	.25
Q1	Transistor, NPN	FBN-L102	2.40
Q2	Transistor, PNP	FBN-L103	1.76
R3	Res., film 200 ohms ± 5% 1/2w	DCR-20-010	.20
R4	Res., thermistor 425 ohms ± 5% 1-1/4	DKB-43-001	1.52
R5	Res., comp., 1200 ohms ± 10% 1/2w	DEB-1221	.12
R6	Same as R5		
R7	Res., comp., 33 ohms ± 5% 1/4w	DCB-3305	.15
R8	Res., comp., 15000 ohms ± 10% 1/2w	DEB-1531	.12
R10	Same as R5		
SCR1	Rectifier, silicon, controlled	FBP-00-009	.95

UNIQUE PARTS

MODEL LMOV-1F

R1	Res., var., ww, 2000 ohms ±10% 1w	DMS-20-034	3.00
R2	Res., film, 560 ohms ± 2% 1/2w	DCR-56-002	.65
R9	Res., comp., 22 ohms ± 10% 1/2w	DEB-2201	.12

MODEL LMOV-2F

R1	Res., var., ww, 5000 ohms ± 10% 1w	DNS-50-036	3.15
R2	Res., film 1470 ohms ± 1% 1/2w	DCS-15-031	.30
R9	Res., comp., 68 ohms ± 10% 1/2w	DEB-6801	.12

PARTS FOR "Y" OPTION

C107	Cap., elect., 40 mf 35vdc	CBP-40-014	1.68
CR1	Rectifier, zener diode	FBM-Z107	3.75
CR101	Rectifier, zener diode	FBM-Z104	4.35
Q101	Transistor, NPN	FBN-L109	2.75
R4	Res., comp., 220,000 ohms ± 10%, 1/2w	DEB-2241	.12
R101	Res., film, 6800 ohms ± 2%, 1/4w	DCS-68-032	.30
R102	Res., film, 220 ohms ± 2%, 1/4w	DCR-22-014	.30

PARTS FOR "T" OPTION

On transformer T1 of all LM-H units, add suffix "T" to standard part number; prices remain the same. The following parts change and a series resistor is added to DS-1.

PARTS FOR "T" OPTION (Cont)

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C1	Cap., paper, 0.15 mf ± 10%, 600vdc	CAM-15-019	$ 1.80
DS1 (Res.)	Res., comp., 68000 ohms ± 10% 1/2w	DEB-6831	.68
F1	Fuse, "SLO-BLO", 15.0 amps, 250V	FFG-15-000	.25
XF1	Fuseholder	HRM-00-007	1.60

PARTS FOR "V" OPTION

H package models with the "V" option have the same part changes as listed for the "T" option except for transformer listed below.

T1	Transformer	Add Suffix "V" to Reg. T1 No	Same as Reg. T1

PARTS FOR "R" OPTION

Variable resistor R1 and transformer T1 change on all "H" package models with suffix "R". Part no. changes for R1 are listed here. For transformer T1 used in these models see standard "H" model parts lists for the standard transformer part no. and add suffix "R" to the part no. Price for T1 does not change.

MODEL LM-H3

R1	Res., var., ww 300 ohms ± 5%, 5w	DNR-30-031	6.25

MODELS LM-H3P6—LM-H6

R1	Res., var., ww, 600 ohms ± 5%, 5w	DNR-60-032	6.25

MODELS LM-H10, LM-H12, LM-H-0-7

R1	Res., var., ww, 2200 ohms ± 5%, 5w	DNS-22-070	6.25

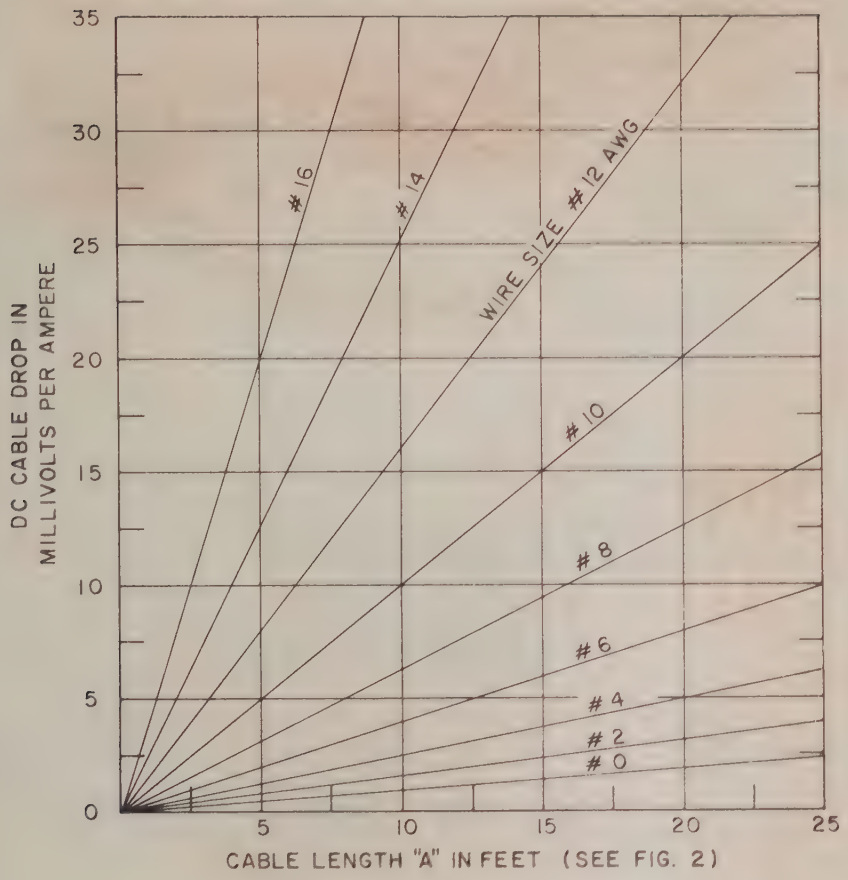


Figure 1. Cable Connection Chart

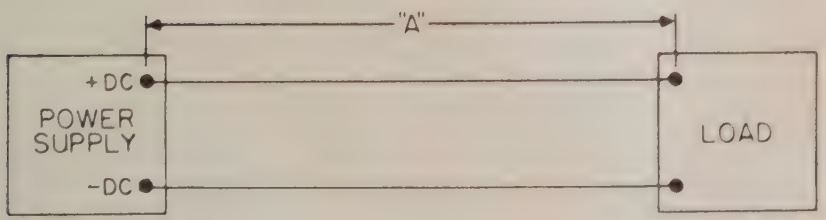
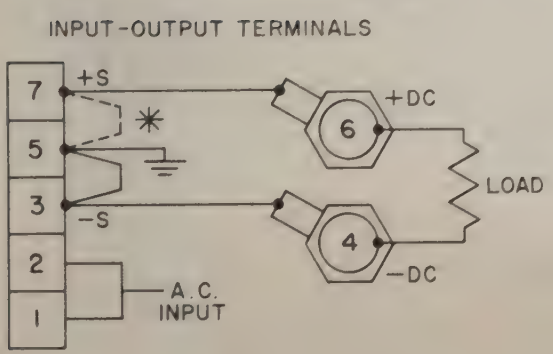
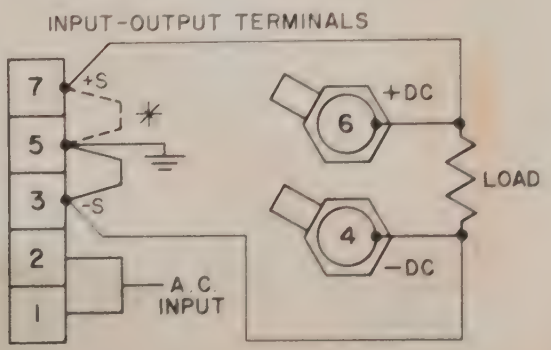


Figure 2. Cable Length "A" in Feet



NOTE:
✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

Figure 3. Local Sensing Connections



NOTE:
✳ FOR POSITIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

Figure 4. Remote Sensing Connections

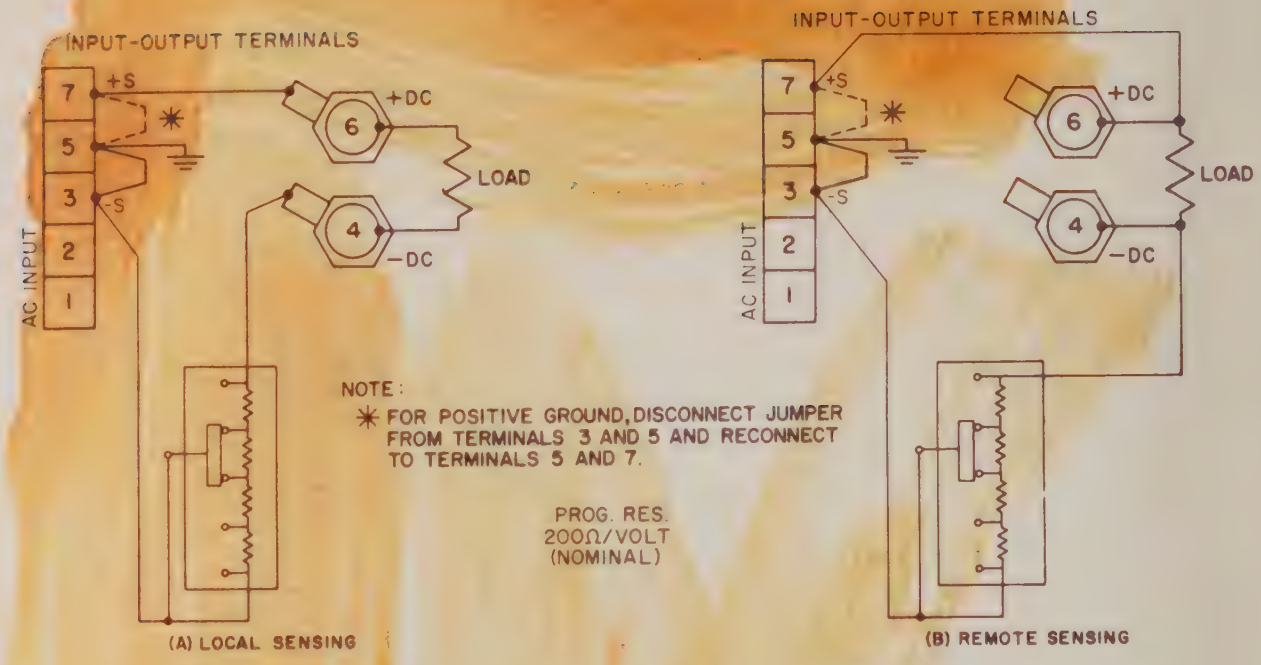


Figure 5. Programmed Voltage With External Resistor

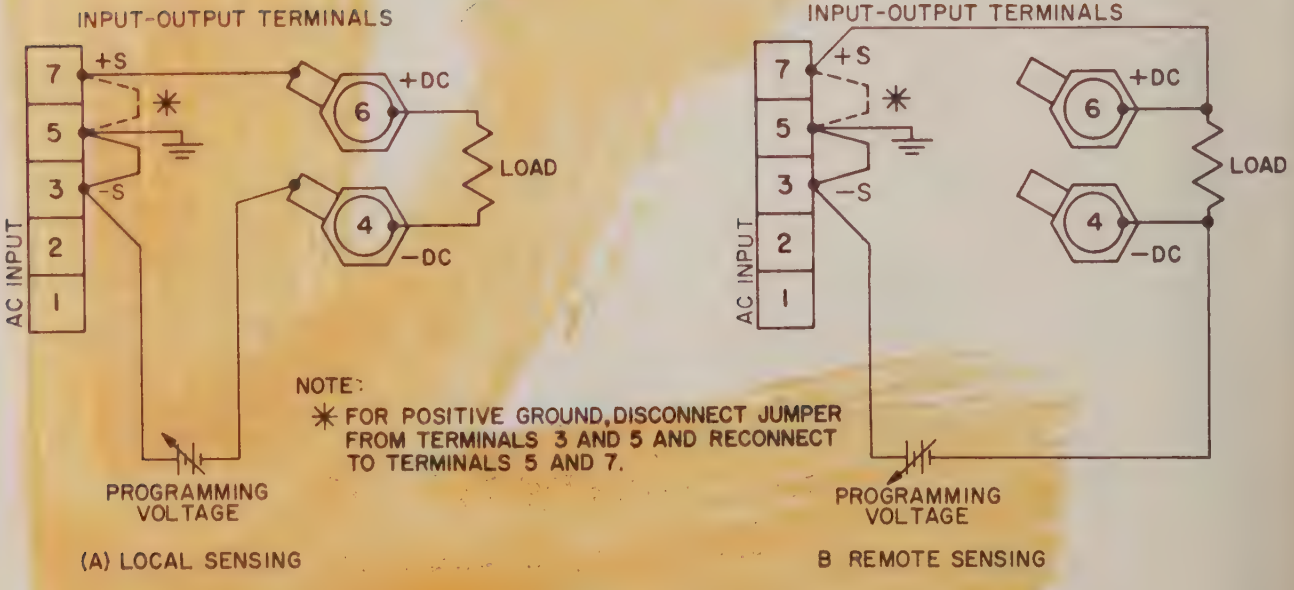


Figure 6. Programmed Voltage With External Programming Voltage Source

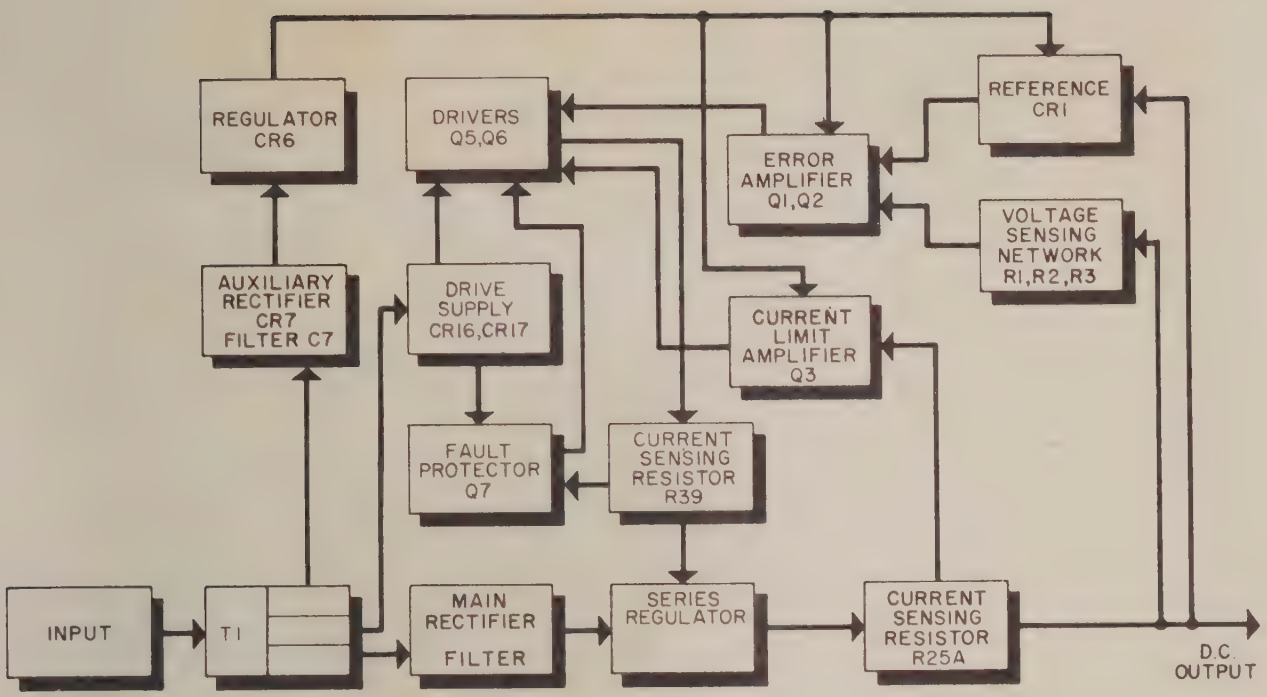
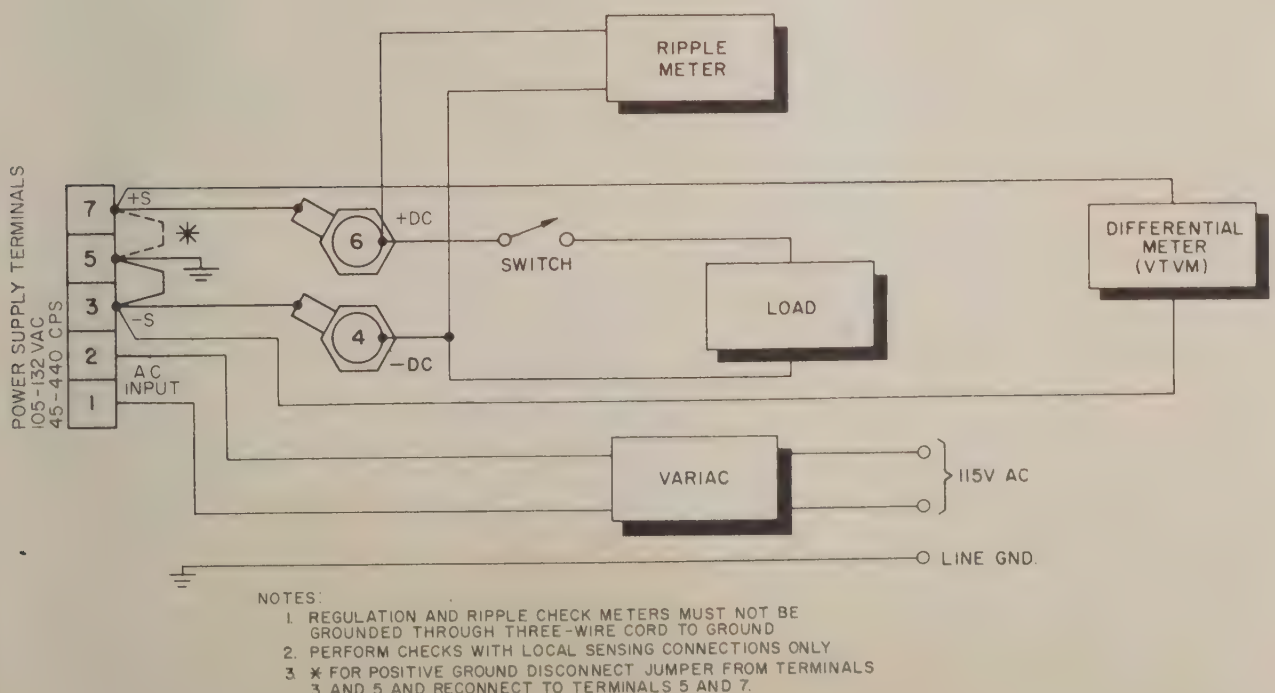
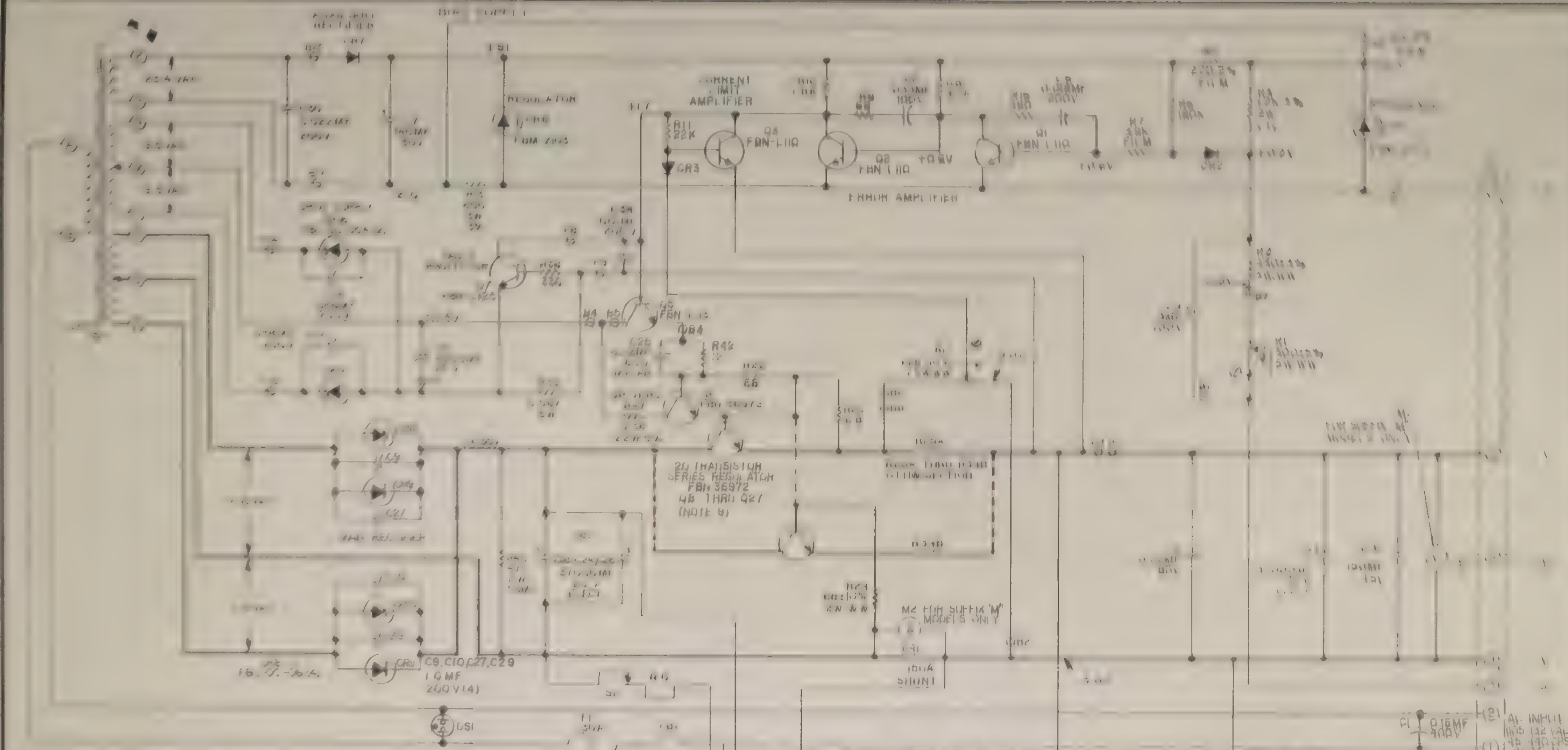


Figure 7. Typical Block Diagram



NOTES:
1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE CORD TO GROUND
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY
3. * FOR POSITIVE GROUND DISCONNECT JUMPER FROM TERMINALS 3 AND 5 AND RECONNECT TO TERMINALS 5 AND 7.

Figure 8. Test Connections for Performance Checks



NOTES

1. RESISTOR VALUES ARE IN OHMS
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMP ±10%, WIREWOUND ±5%; FILM ±5%, UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED
5. SYMBOLS
   - INDICATES CLOCKWISE ROTATION OF SHAFT
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS
   - INDICATES ACTUAL UNIT MARKING
   - * SEE INSTRUCTION MANUAL.
   - LAMBDA PT #FBL-00-030, USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS
7. DERATE CURRENT 10% FOR 45-55 CPS. FOR 360-440 CPS, SEE INSTRUCTION MANUAL.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115VAC, 60CPS, OUTPUT NOM'L VDC NO LOAD INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.

REF DES NOT USED		
C8	CR4,CR5	R12
C11-C14	CR12,CR13	R14,R15
C28	Q4	R18-R21
C32,C33		R35 R37
		R43-R46

OVERVOLTAGE PROTECTION CIRCUIT

FOR SUFFIX "OV" MODELS

SCR71 FBP-00-010

SCR1 FBP-00-009

Q2 FBN 1103

Q1 FBN 1102

C1 0.01MF 50V MYLAR

R6 1200

R2 560±2%

R3 22

R6 1200

R33 2 3W

RATING TABLE	
AMB TEMP	MAX LOAD
40°C	160A
50°C	140A
60°C	126A
71°C	81A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY TO LOAD WIRING DIAGRAMS

BUTTER CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION

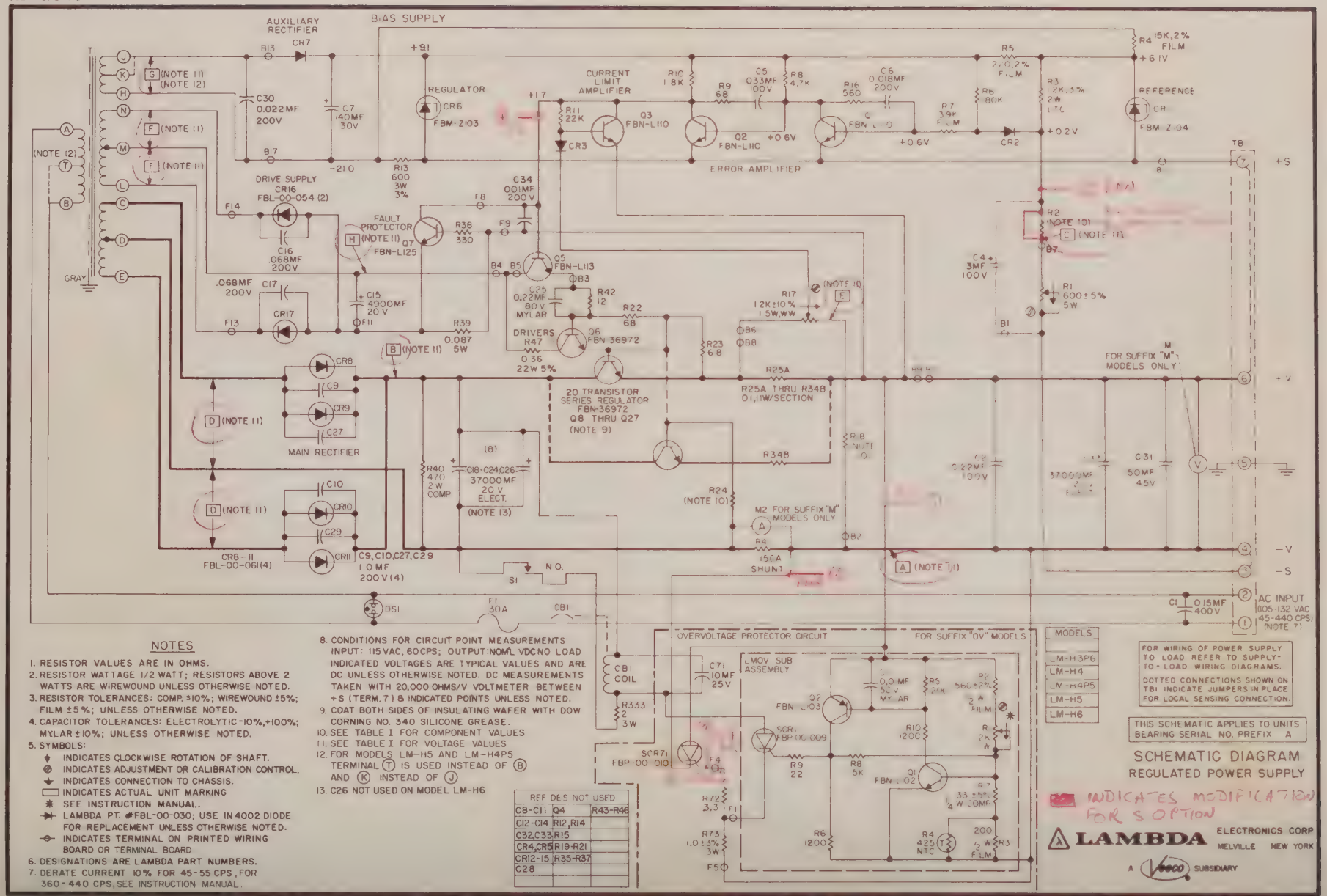
THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODEL LM H3 3VDC

LAMBDA ELECTRONICS CORP MELVILLE NEW YORK

A VEECO SUBSIDIARY



NOTES

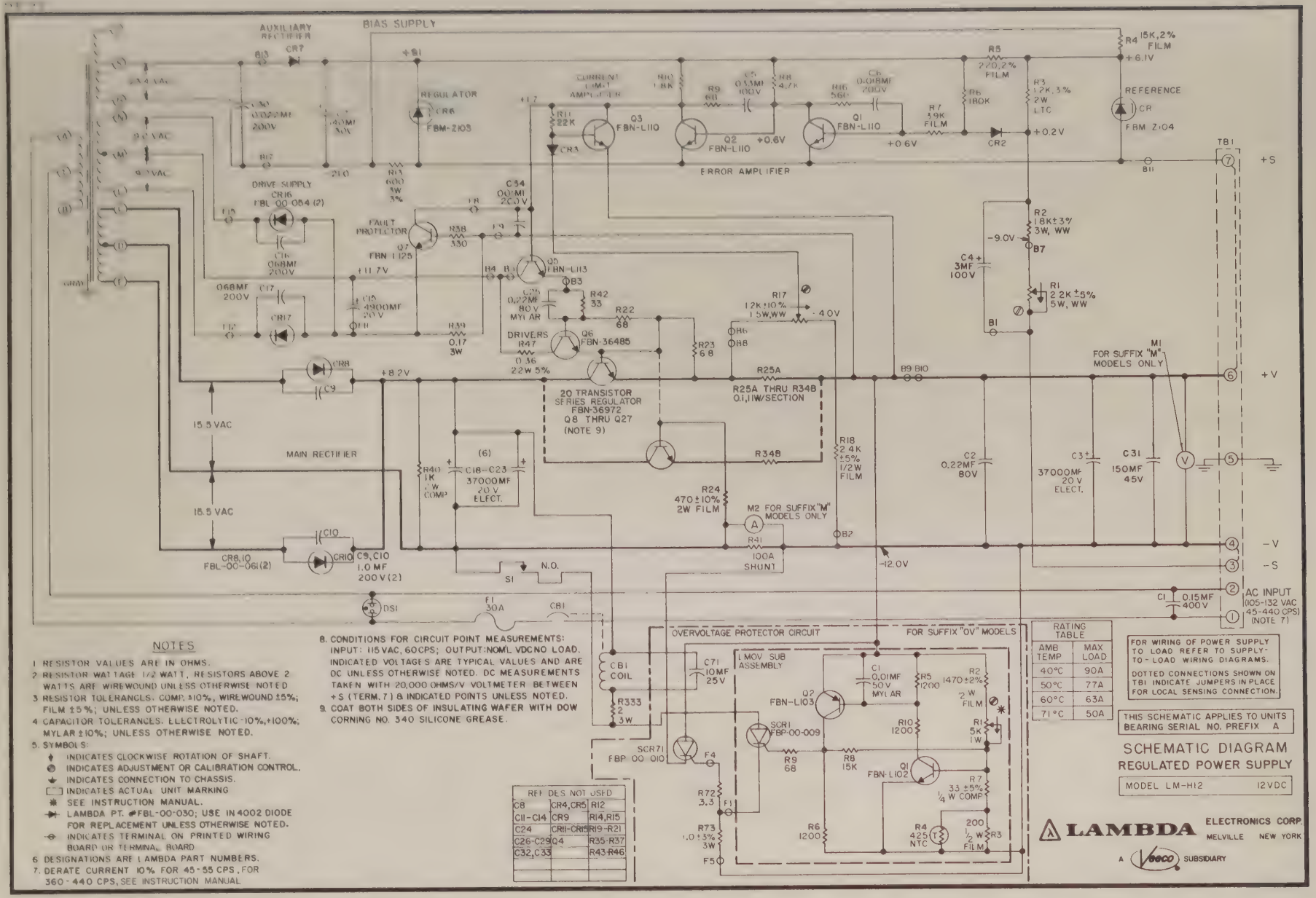
1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DERATE CURRENT 10% FOR 45-55 CPS, FOR 360-440 CPS, SEE INSTRUCTION MANUAL.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60 CPS; OUTPUT: NOML VDC NO LOAD INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES
11. SEE TABLE I FOR VOLTAGE VALUES
12. FOR MODELS LM-H5 AND LM-H4P5 TERMINAL (T) IS USED INSTEAD OF (B) AND (K) INSTEAD OF (J)
13. C26 NOT USED ON MODEL LM-H6

REF DES NOT USED		
C8-C11	Q4	R43-R46
C12-C14	R12, R14	
C32, C33	R15	
CR4, CR5	R19-R21	
CR12-15	R35-R37	
C28		

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

INDICATES MODIFICATION FOR S OPTION

LAMBDA ELECTRONICS CORP MELVILLE NEW YORK
A VECO SUBSIDIARY



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%, WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DERATE CURRENT 10% FOR 45-55 CPS, FOR 360-440 CPS, SEE INSTRUCTION MANUAL
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60 CPS; OUTPUT: NOML VDC NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.

REF DES NOT USED		
C8	CR4,CR5	R12
C11-C14	CR9	R14,R15
C24	CR11-CR15	R19-R21
C26-C29	C34	R35-R37
C32,C33		R43-R46

RATING TABLE	
AMB TEMP	MAX LOAD
40°C	90A
50°C	77A
60°C	63A
71°C	50A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TBI INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

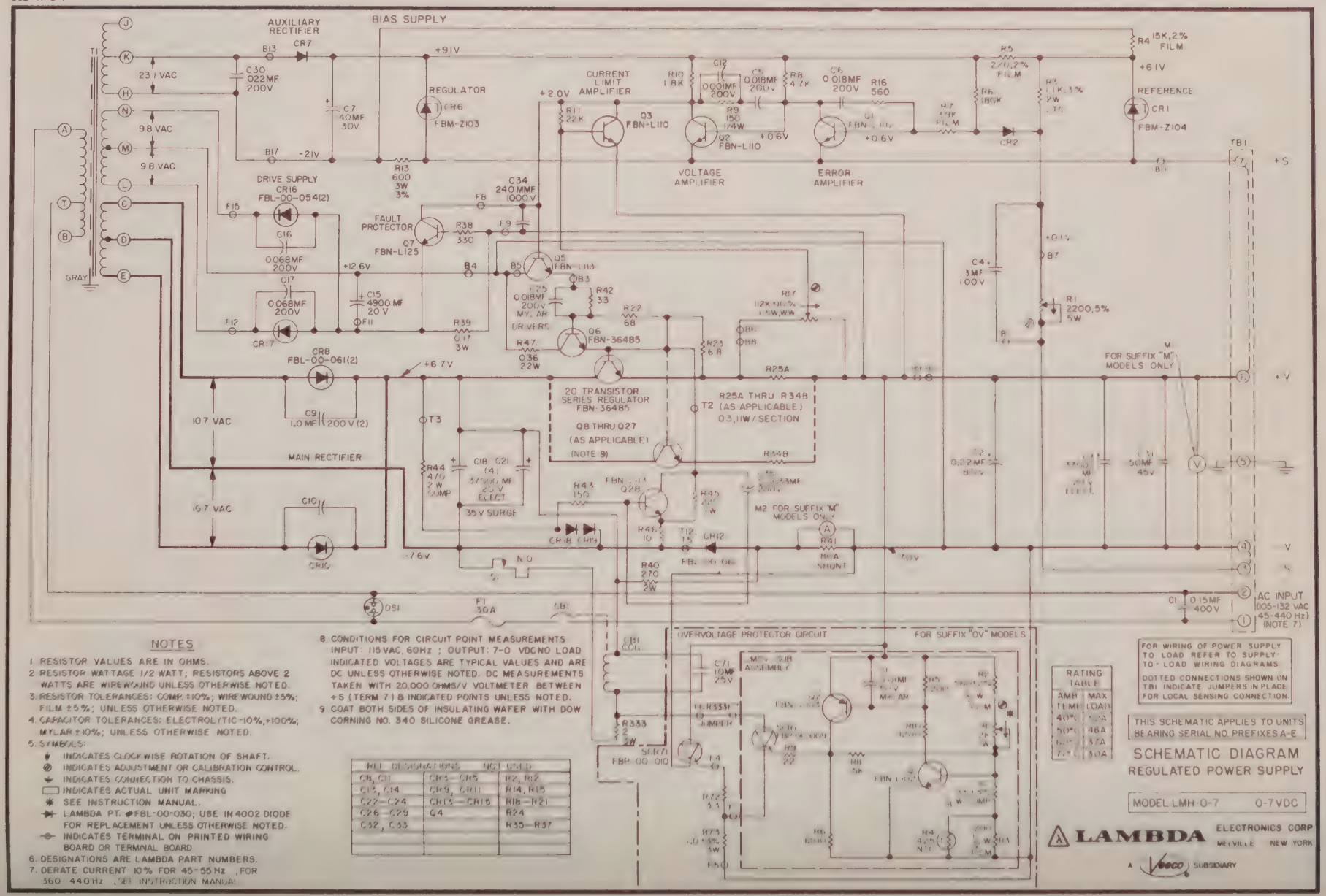
SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODEL LM-H12 12VDC

LAMBDA ELECTRONICS CORP. MELVILLE NEW YORK

A Veeco SUBSIDIARY

SCB-H-0-7



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±5%; FILM ±5%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%; MYLAR ±10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ACTUAL UNIT MARKING
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. #FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DERATE CURRENT 10% FOR 45-55 Hz , FOR 360-440 Hz , SEE INSTRUCTION MANUAL.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS INPUT: 115 VAC, 60Hz ; OUTPUT: 7-0 VDC NO LOAD INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.

REF DESIGNATIONS	NOT USED	
C8, C11	CR3 - CR5	R2, R12
C13, C14	CR9, CR11	R14, R15
C22 - C24	CR13 - CR15	R18 - R21
C26, C29	Q4	R24
C32, C33		R35 - R37

RATING TABLE	
AMB (TEMP)	MAX LOAD
40°C	50A
50°C	46A
60°C	37A
71°C	30A

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

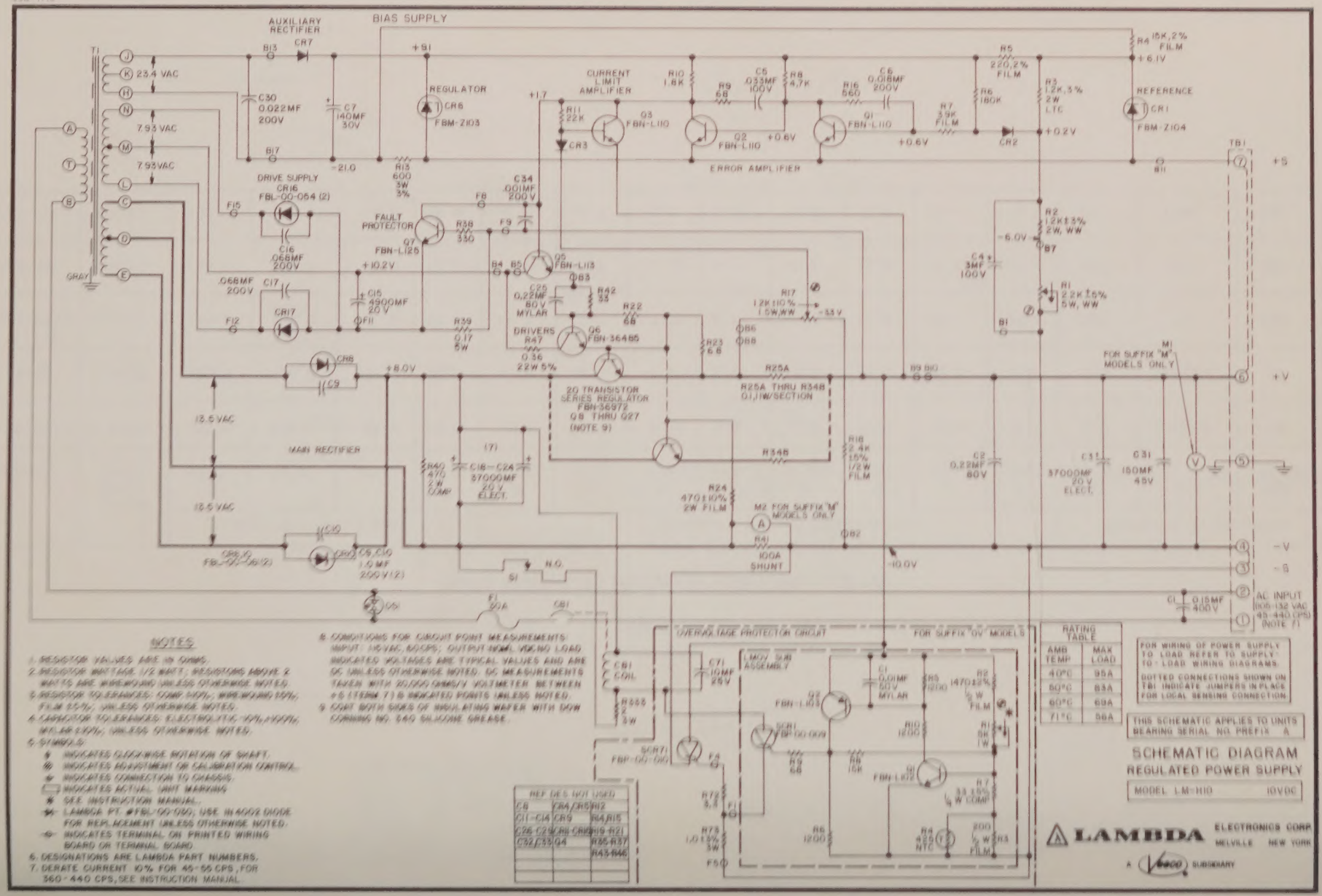
MODEL LMH-0-7 0-7VDC

LAMBDA ELECTRONICS CORP MELVILLE NEW YORK
A Veeco SUBSIDIARY

TABLE I

DATA REFERENCES FOR MODELS LM-H3P6 — LM-H6

Model	Voltage Range (VDC)	Max. Current (Amps)				Schematic Voltage Measurement								Schematic Components		
		40°C	50°C	60°C	71°C	A (VDC)	B (VDC)	C (VDC)	D (VAC)	E (VDC)	F (VAC)	G (VAC)	H (VDC)	R2 3%, 3W	R18 5%, 1/2W	R24 10%, 2W
LM-H3P6	3.6±5%	130.0	109.0	90.0	69.0	-3.6	+6.95	-2.15	8.0	-3.6	10.6	23.4	+14.0	430	Jumper	68
LM-H4	4.0±5%	135.0	118.0	100.0	74.0	-4.0	+6.55	-3.0	8.0	-4.0	10.6	23.4	+14.0	600	Jumper	68
LM-H4P5	4.5±5%	120.0	104.0	84.0	66.0	-4.5	+7.1	-3.25	8.7	-3.4	11.8	23.4	+15.4	650	390	180
LM-H5	5.0±5%	130.0	110.0	90.0	70.0	-5.0	+6.6	-3.25	8.7	-2.4	11.8	23.4	+15.4	650	1300	180
LM-H6	6.0±5%	117.0	100.0	84.0	66.0	-6.0	+7.3	-4.0	9.95	-2.86	9.0	23.4	+11.9	800	1300	180



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/2 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: COMP 10%, WIREWOUND 5%, FILM 2%, UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%,+100%, MYLAR 20%, UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - ↻ INDICATES CLOCKWISE ROTATION OF SHAFT.
   - ⫽ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - ⏚ INDICATES CONNECTION TO CHASSIS.
   - ▭ INDICATES ACTUAL UNIT MARKING.
   - ✱ SEE INSTRUCTION MANUAL.
   - ✱ LAMBDA PT. #FBL-00-060, USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - ⊕ INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. DERATE CURRENT 10% FOR 45-55 CPS, FOR 360-440 CPS, SEE INSTRUCTION MANUAL.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT 115VAC, 60 CPS; OUTPUT NOMINAL VOLTS NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN ⏚ (TERM 7) & INDICATED POINTS UNLESS NOTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.

REF DES NOT USED		
C8	CR4/CR5	R12
C11-C14	CR9	R14,R15
C26-C29	CR11-CR12	R19-R21
C32,C33	Q4	R35-R37
		R43-R46

RATING TABLE	
AMB TEMP	MAX LOAD
40°C	95A
50°C	83A
60°C	69A
71°C	56A

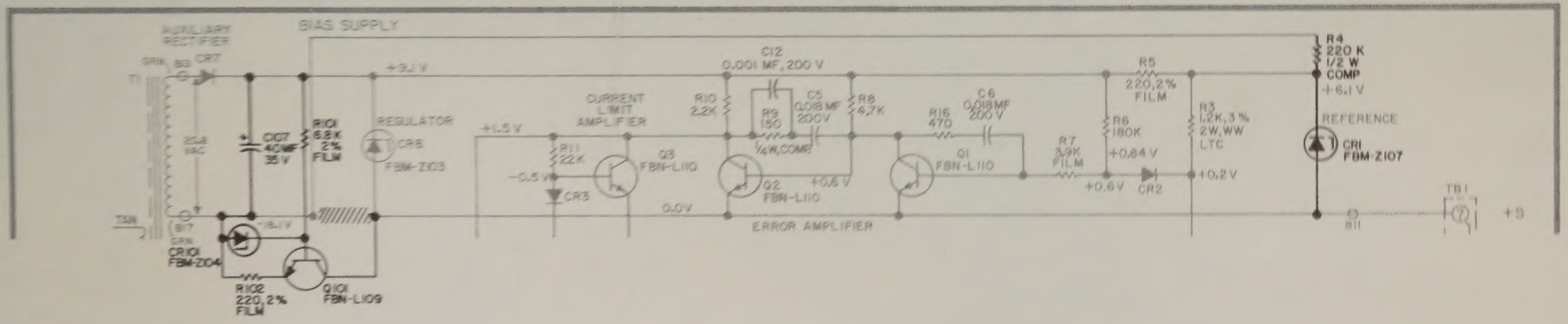
FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODEL LM-H10 10VDC

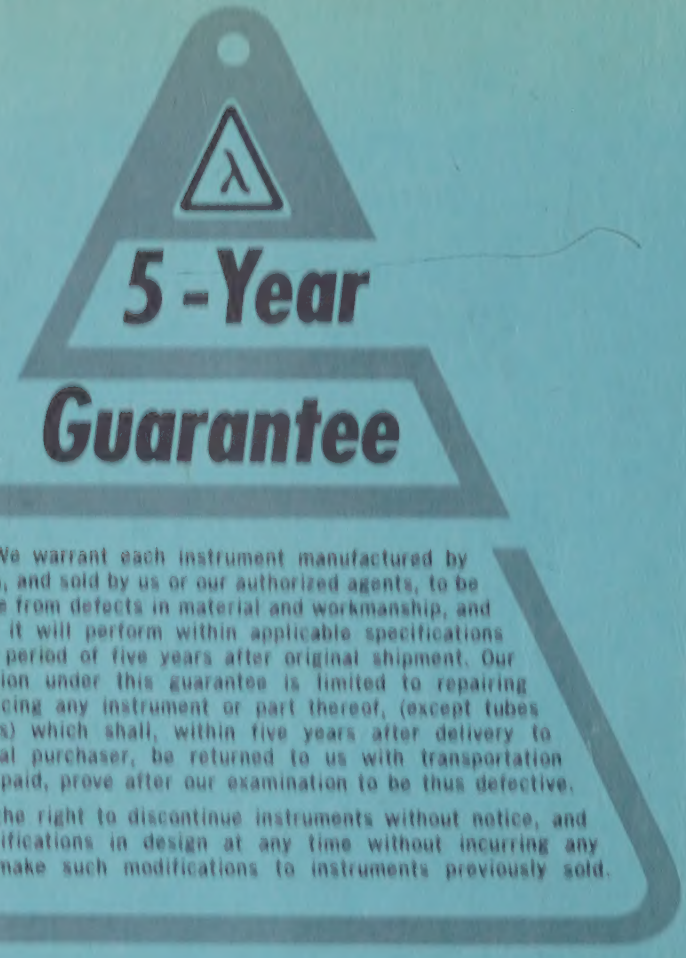
LAMBDA ELECTRONICS CORP MELVILLE NEW YORK
A Veeco SUBSIDIARY



NOTES:
1. "Y" OPTION COMPONENTS ARE SHOWN IN SOLID BLACK LINE.
2. REFER TO POWER SUPPLY SCHEMATIC DIAGRAM IN THIS MANUAL FOR ALL OTHER COMPONENTS LOCATED ON THE UNIT.
3. FOR "Y" OPTION SCHEMATIC R4 CHANGES VALUE, C7 BECOMES C107 AND CHANGES VALUE; R13 IS DELETED; R101, CR101, R102, Q101 ARE ADDED; CR1 PART NO. CHANGES.

TYPICAL "Y" OPTION SCHEMATIC DIAGRAM

LAMBDA
ELECTRONICS CORP.
MELVILLE NEW YORK


5 - Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS CORP.
515 BROAD HOLLOW ROAD • MELVILLE, L. I., NEW YORK • 516 MYRTLE 4-4200

www.manualsplus.com
1008508

A Veeco SUBSIDIARY